

CLEAN SET OF CLAIMS AFTER AMENDMENT

1. A linear stepper motor, comprising;
  - (a) an annular stator structure;
  - (b) an axially extending, cylindrical, permanent magnet shaft extending coaxially through said annular stator structure; [and]
  - (c) said axially extending, cylindrical, permanent magnet shaft having a smooth external surface along a portion thereof with axially alternating N and S poles defined circumferentially in an outer periphery of said portion of said axially extending, cylindrical, smooth, permanent magnet shaft; [and]
  - (d) said axially extending, cylindrical, permanent magnet shaft is formed from one homogeneous piece of material; and
  - (e) said portion of said axially extending, cylindrical, permanent magnet shaft is hollow.
8. A linear stepper motor, as defined in Claim 1, wherein: said axially extending, cylindrical, smooth, permanent magnet shaft can rotate 360° continuously or intermittently in any direction, regardless of whether or not said linear stepper motor is energized.
9. A linear stepper motor, as defined in Claim 1, wherein: said axially extending, cylindrical, smooth, permanent magnet shaft is back-driveable.
10. A linear stepper motor, as defined in Claim 1, wherein: said linear stepper motor is constructed to operate in any orientation.
11. A linear stepper motor, as defined in Claim 1, wherein: said stator structure has modular stator stacks with pole pieces to concentrate and direct magnetic flux.

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12. A linear stepper motor as defined in Claim 1, wherein: said stator structure has conventionally wound coils.

14. A linear stepper motor, as defined in Claim 1, wherein: said linear stepper motor includes no lead screw and no ball screw.

15. A linear stepper motor, as defined in Claim 1, wherein: said linear stepper motor requires no lubrication of coengaged parts thereof.

16. A linear stepper motor, as defined in Claim 1, wherein: said linear stepper motor requires no conversion of rotary motion to linear motion.

23. A linear stepper motor, comprising:

- (a) an annular stator structure;
- (b) an axially extending, cylindrical, permanent magnet shaft extending coaxially through said annular stator structure;
- (c) said axially extending, cylindrical, permanent magnet shaft having a smooth external surface along a portion thereof with axially alternating N and S poles defined circumferentially in an outer periphery of said portion of said axially extending, cylindrical, smooth, permanent magnet shaft;
- (d) said portion of said axially extending, cylindrical, permanent magnet shaft has a solid core; and
- (e) said solid core is formed from a non-magnetic material.

24. A linear stepper motor, comprising;

- (a) an annular stator structure;
- (b) an axially extending, cylindrical, permanent magnet shaft extending coaxially through said annular stator structure;
- (c) said axially extending, cylindrical, permanent magnet shaft having a smooth external surface along a portion thereof with axially alternating N and S poles defined circumferentially in an outer periphery of said portion of said axially extending, cylindrical, smooth, permanent magnet shaft; and
- (d) said stator structure includes annular disks of a high lubricity material spacing apart elements of said stator structure and serving as bearing surfaces for said axially extending shaft.

25. A linear stepper motor, as defined in Claim 23, wherein: said stator structure includes annular disks of a high lubricity material spacing apart elements of said stator structure and serving as bearing surfaces for said axially extending shaft.

26. A linear stepper motor, as defined in Claim 23, wherein: said axially extending, cylindrical, smooth, permanent magnet shaft can rotate 360° continuously or intermittently in any direction, regardless of whether or not said linear stepper motor is energized.

27. A linear stepper motor, as defined in Claim 23, wherein: said axially extending, cylindrical, smooth, permanent magnet shaft is back-driveable.

28. A linear stepper motor, as defined in Claim 23, wherein: said linear stepper motor is constructed to operate in any orientation.

29. A linear stepper motor, as defined in Claim 23, wherein: said stator structure has modular stator stacks with pole pieces to concentrate and direct magnetic flux.

30. A linear stepper motor as defined in Claim 23, wherein: said stator structure has conventionally wound coils.

31. A linear stepper motor, as defined in Claim 23, wherein: said linear stepper motor includes no lead screw and no ball screw.

32. A linear stepper motor, as defined in Claim 23, wherein: said linear stepper motor requires no lubrication of coengaged parts thereof.

33. A linear stepper motor, as defined in Claim 23, wherein: said linear stepper motor requires no conversion of rotary motion to linear motion.

34. A linear stepper motor, as defined in Claim 24, wherein: said portion of said axially extending, cylindrical, permanent magnet shaft is hollow.
35. A linear stepper motor, as defined in Claim 24, wherein: said axially extending, cylindrical, smooth, permanent magnet shaft can rotate 360° continuously or intermittently in any direction, regardless of whether or not said linear stepper motor is energized.
36. A linear stepper motor, as defined in Claim 24, wherein: said axially extending, cylindrical, smooth, permanent magnet shaft is back-driveable.
37. A linear stepper motor, as defined in Claim 24, wherein: said linear stepper motor is constructed to operate in any orientation.
38. A linear stepper motor, as defined in Claim 24, wherein: said stator structure has modular stator stacks with pole pieces to concentrate and direct magnetic flux.
39. A linear stepper motor as defined in Claim 24, wherein: said stator structure has conventionally wound coils.
40. A linear stepper motor, as defined in Claim 24, wherein: said linear stepper motor includes no lead screw and no ball screw.
41. A linear stepper motor, as defined in Claim 24, wherein: said linear stepper motor requires no lubrication of coengaged parts thereof.
42. A linear stepper motor, as defined in Claim 24, wherein: said linear stepper motor requires no conversion of rotary motion to linear motion.